

BERKOVSKIY, A. G.

"Some Results on the New Types of Industrial Photo-Electron Multipliers"
"Some Results on the Photo-Electron Multipliers suitable for the
Discrimination of Short-Time Intervals"

A conference on Electron and Photo-electron Multipliers; Radiotekhnika i
Elektronika, 1957, Vol. II, No. 12, pp. 1552 - 1557 (USSR)

Abst: A conference took place in Moscow during February 28 and March 6, 1957
and was attended by scientists and engineers from Moscow, Leningrad, Kiev
and other centres of the Soviet Union. Altogether, 28 papers were read and
discussed.

Berkovskiy, A. G.

AUTHORS: Leyteyzen, L. G. , Berkovskiy, A. G. , Breydo, I. Ya. , Glukhovskoy, B. M. , Korol'kova, O. S. , Tarasova, Ye. I. 48-12-15/15

TITLE: New Industrial Types of Photoelectron Multipliers (Novyye promyshlennyye tipy fotoelektronnykh umnozhitel'ey)

PERIODICAL: Izvestiya AN SSSR, Seriya Fizicheskaya, 1957, Vol. 21, Nr 12, pp. 1653 - 1659 (USSR)

ABSTRACT: At present the production and delivery of some new photoelectron-multipliers (FEV) worked out by the authors were begun on an industrial scale. They are shortly described here. 1.) The production of the special multiplier for the scintillation-spectrometers $\Phi\Xi\Upsilon$ -29 was recently begun. It has a good amplitude-dissolving power which is guaranteed by the comparatively high sensitivity of the cathodes of the device. The integral sensitivity is higher than $30 \mu A \text{ lm}^{-1}$, on the average $40 - 45 \mu A \text{ lm}^{-1}$, the "blue" one is higher than $6 \mu A \text{ ml}^{-1}$ which corresponds to a quantum discharge of more than 9 % at $\lambda \approx 4000 \text{ \AA}$. Besides the electron-optics at the entrance of the multiplier guarantees a good taking over of the electrons from the cathode to the dynode, as well as minimum losses in the first cascades. The amplitude of the noise, measured in relation to the photopeak of $\text{Cs}^{137} \rightarrow \text{NaJ(Tl)}$ on the 50

Card 1/4

New Industrial Types of Photoelectron Multipliers

48-12-15/15

impulse sec^{-1} -level, is not higher than $5 \pm 8 \text{ keV}$. The light-characteristic is linear up to the amplitude of the initial impulse $= 7 - 8 \text{ V}$ at a load of about $50 \text{ k}\Omega$ and a parasitic capacity of $\leq 10 \text{ pF}$, with the method of operation given in the pass filter of the device. The most important operation-parameter of any FEV is the stability. Most of the $\Phi \Xi \gamma - 29$ under the usual conditions in the gamma-spectrometers work sufficiently stable. Experiments with dynodes of different alloys are now made for improving the stability. At the same time the influence of technological factors and the construction of dynodes upon the stability of the FEV is also experimentally investigated.

2.) FEV with enlarged cathode. According to the preliminary data these multipliers have the following average static parameters: integral sensitivity of the cathode $35 - 40 \mu \text{ A lm}^{-1}$; the "blue" sensitivity $- 7 \mu \text{ A lm}^{-1}$. Amplification about $(2 \pm 5) \cdot 10^5$ at full voltage of $1400 - 1500 \text{ V}$. At much higher voltages it can attain 10^7 . The density of the heat flow from the cathode on the average amounts to $5 \cdot 10^{-15} \text{ Acm}^{-2}$.

3.) "Time"-FEV. Beside the "general" parameters the minimum scattering according to the time of passage of the "electron-parcel" through the multiplier in the case of a maximum steep front of the initial impulse is also demanded of it. After the modelling of many

Card 2/4

New Industrial Types of Photoelectron Multipliers

48-12-15/15

variants a system was found which guarantees good focusing of the electrons and minimum scattering of the time of flight. The calculations of the maximum time-of-flight gradient in this multiplier system with grid yielded a quantity of $4,4 \cdot 10^{-10}$ sec (at a voltage of 100 V/cascade) which is 3 - 4 times less than in the multiplier-system H4646 (reference 3).

4.) The best ratio of the signal to the background in the wave-range of 5500 to 8000 Å is given by the bismuth-silver-cesium cathodes. The experimental samples of multipliers with such cathodes are produced in two sizes: that of the $\Phi \ni Y$ -29 and in a smaller size. The multipliers have 11 cascades. Their integral sensitivity of the cathodes on the average is $45 - 50 \mu A \text{ lm}^{-1}$. The amplification is of the order of magnitude $10^5 - 10^6$ at a full supply-voltage of 1400 - 1600 V. The smaller multiplier is distinguished by a great vibration-strength.

5.) The miniature-FEV. At present a construction was worked out for an eight-cascade-miniature-multiplier $\Phi \ni Y$ whose outside diameter is greater than 22,5 mm and whose height is 65 mm without peg. The flat, semi-transparent cathode of antimony-cesium has a working diameter of 18 mm. Its sensitivity is below $25 \mu A \text{ lm}^{-1}$.

Card 3/4

New Industrial Types of Photoelectron Multipliers

48-12-15/15

It guarantees an amplification up to 10^5 at a voltage of 900 - 100V.
The dark currents are of the order of magnitude 10^{-8} A.
There are 8 figures, and 3 references, 1 of which are Slavic.

AVAILABLE:

Library of Congress

Card 4/4

BERKOVSKIY, A. G.

AUTHORS: Berkovskiy, A.G. and Leyteyzen, L.G.

109-3-15/23

TITLE: A Miniature Photo-electron Multiplier with a Bulky Cathode
(Miniatyurnyy fotoelektronnyy umnozhitel' s massivnym katodom)

PERIODICAL: Radiotekhnika i Elektronika, 1958, Vol.III, No.3,
pp. 421-427 (USSR).

ABSTRACT: The multiplier is fitted with an antimony-caesium cathode, which is suitable for the operation with light beams having a diameter of about 2 mm. The emitters are also Sb-Cs-coated and are constructed in the shape of a box (see Fig.2a). There are 7 emitters and a special anode which is in the form of a grid, parallel to the surface of the last emitter (see Fig.2b). Dimensions of the multiplier are 58 mm in height and 22 mm in diameter. Overall sensitivity of the multiplier was measured at a light flux of 3×10^{-7} lm and the sensitivity of the cathodes was investigated at 3×10^{-5} lm, the diameter of the light beam being 2.15 mm in each case. Results of the measurements on 20 laboratory samples of the photo-multiplier are shown in Table 1 on p.423. It was found that the average cathode sensitivity was 28 μ A/lm. This was thought to be satisfactory for most practical applications. The average Card1/3 amplification of the photo multipliers was 10^5 at the overall

109-3-15/23

A Miniature Photo-electron Multiplier with a Bulky Cathode

supply voltage of 900 V; the voltage per stage was thus 113 V and the amplification 5.2. If the overall voltage was 800 V, a total amplification was 5×10^4 . Voltage current characteristics of the multipliers were also measured and two typical curves are shown in Fig.4; Curve M represents the overall amplification as a function of the inter-stage voltage, while Curve I_T represents the dark current as a function of the voltage. Noise and threshold sensitivity of the 20 samples were also measured and the results are reported in Table 2 on p.424; the threshold sensitivity, as a function of the voltage per stage, is shown in Fig.5. Anode characteristics of the multipliers for two different values of the output current are given in Fig.6. The construction of the multiplier is such that the anode current is dependent on the position of the light spot on the surface of the cathode. It was of interest, therefore, to investigate this effect. A beam having a diameter of 1.05 mm was used for the purpose and the sensitivity curves obtained by this means are shown in Fig.7. It is seen that the edge portions of the cathode have the highest sensitivity. This effect is thought to be due to the presence of two angles at the edges of the cathode. This was confirmed by the fact

Card2/3

A Miniature Photo-electron Multiplier with a Bulky Cathode 109-3-15/23

that, if an additional angle (threshold) was placed in the middle of the cathode, the sensitivity had an additional maximum in the centre of the cathode. On the basis of Figs. 7 and 8, it is concluded that the reason for the increased sensitivity of the cathode in the regions close to the angles is the focusing of the photo-electrons on to that portion of the first emitter which directs the highest possible number of the electrons on to the second emitter.

There are 9 figures, 2 tables and 5 references, 2 of which are Russian, 2 English and 1 German.

SUBMITTED: January 10, 1957

AVAILABLE: Library of Congress
Card 3/3

AUTHOR: Berkovskiy, A. G.

89-4-5-10/26

TITLE: A New Photomultiplier for Scintillation Counters (Novyy fotoelektronnyy umnozhitel' dlya stsintillyatsionnykh schetchikov)

PERIODICAL: Atomnaya Energiya, 1958, Vol 4, Nr 5, pp. 466 - 468 (USSR)

ABSTRACT: In the diode system of the Soviet multiplier, ~~FEU~~ a bent grid is mounted in front of each diode which serves as an additional accelerating electrode. The new multiplier type is given the trade mark ~~FEU-33~~. The accelerating grids decrease the difference of the time of the flight of the secondary electrons between the diodes which is conditioned by the different initial velocities of the electrons. At the ~~same time~~ the multiplier can take higher current loads. The grids which are placed in front of the i -th diode are connected with the $(i + 2)$ -th diode. The diodes have a semicircular bow which ends in two straight pieces. The grid consists of two straight parts which form an

Card 1/2

89-4-5-10/26

A New Photomultiplier for Scintillation Counters

obtuse angle.

Such a multiplier which consists of 13 antimony-caesium diodes reaches an amplification of 10^8 at a total voltage of from 2500 to 3000 volts. The dependence of the amplification coefficient and of the dark conduction on the feeding voltage was measured and is represented graphically. There are 3 figures and 4 references, 2 of which are Soviet.

SUBMITTED: August 27, 1957

AVAILABLE: Library of Congress

1. Scintillation counters—Equipment
 2. Electron multipliers
- Applications

Card 2/2

AUTHORS:

Leyteyzen, L. G., Berkovskiy, A. G.,
Glukhovskoy, B. M., Korol'kova, O. S., Tarasova, Ye. I. 48-22-5-5/22

TITLE:

On Some Characteristics of New Industrial Types of the FEU
(Data From the VIIIth All-Union Conference on Cathode Electronics
Leningrad, October 17-24, 1957) (O nekotorykh kharakteristikakh
novykh promyshlennyykh tipov FEU (Materialy VIII Vsesoyuznogo
soveshchaniya po katodnoy elektronike, Leningrad, 17-24 oktya-
brya 1957 g.))

PERIODICAL:

Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1958
Vol. 22, Nr 5, pp. 513-517 (USSR)

ABSTRACT:

In the years from 1955-1957 several types of multistage photo-
electronic multipliers (fotoelektronnyy umnozhitel' = FEU) were
worked out and brought to the market. They find application in
various fields of physical research. In this paper some data
on this are given: 1) The main particularities of the new FEU
types; They are given for the following types: a) 13-stage mul-
tiplier of the type FEU-29, b) multiplier of the type FEU-24,
a) and b) are used in scintillation counters and spectrometers.
c) multiplier type FEU-33 serves for the investigation of pro-
cesses which are separated by extremely narrow intervals (10^{-9} -
 10^{-10} seconds). d) The domain of application of the multiplier

Card 1/2

On Some Characteristics of New Industrial Types of the FEU 48-22-5-5/22
(Data From the VIIIth All-Union Conference on Cathode Electronics, Leningrad,
October 17-24, 1957)

with a cathode of bismuth-silver-cesium is determined by the particularities of its spectral characteristic (fig. 1). e) A miniature multiplier with a semitransparent cathode of antimony-cesium was worked out for the application in a portable device. f) A further multiplier with a massive antimony-cesium cathode has a lateral optical entrance (Ref 1). The types e) and f) are vibrationproof. Finally the stability of the FEU is discussed, which was investigated by the authors. In the discussion of this abstract participated G. S. Vil'dgrube, and N. S. Khlebnikov. There are 4 figures, 1 table, and 1 reference, which is Soviet

1. Electron multipliers--Properties
2. Electron multipliers--Applications

Card 2/2

AUTHORS: Berkovskiy, A. G., Leyteyzen, L. G., Pol'skiy, V. G. SOV/48-22-8-18/20

TITLE: Industrial Photoelectronic Multipliers With an Improved Time Resolution and Strong Output Currents (Promyshlennyye fotoelektronnyye umnozhiteli s uluchshennym vremennym razresheniyem i bol'shimi vykhodnymi tokami)

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1958, Vol. 22, Nr 8, pp. 1002 - 1004 (USSR)

ABSTRACT: In the conference (Ref 1) last year preliminary data on the new 13-cascade multiplier (FEU = photoelectronic multiplier = FEM) were communicated. This device serves for the investigation of nuclear processes with a fast sequence. The investigations of the parameters and of the characteristics of the FEM-33 recently carried out by the authors yielded the following results: according to the technical assumptions the integral sensitivity of the cathodes of the FEM-33 as well as of the FEM-29 should not be below $30 \mu A \text{ lm}^{-1}$. The mean integral sensitivity of the multiplier cathode which was developed in the last two months amounted to $40 \mu A \text{ lm}^{-1}$. The dependence

Card 1/3

SOV/48-22-8-18/20

Industrial Photoelectronic Multipliers With an Improved Time Resolution and Strong Output Currents

of the amplification of the supply voltage of three specimens of the FEM-33 are given in figure 2 (continuous curves). For comparison the characteristics of three 14-cascade multipliers RCA-6810 are given with dotted lines. These curves were taken under the same conditions. Measurements of the amplitude resolution of the FEM-33 showed that it is by no means inferior to other FEM's. The noise level of the FEM-33 according to the scale of the NaJ-(Tl)-Cs¹³⁷ is of the order 3 - 4 keV (at a counting rate of 50 pulses per sec). The classification of 50 specimens of FEM-33 according to the pulsed output current is given in figure 3. The weakest currents equaled 0,3 A, the highest about 1 A. Investigations of the linearity of the output currents at a voltage of the order of 4 kV showed that on the average the FEM-33 operate linearly up to 0,5 A. The deviations range from 0,4 to 0,8 A (Fig 8). The width of the coincidence curve of 2 specimens of FEM-33 with a crystal and with a preparation Co⁶⁰ in the coincidence circuit is between the limits of 2 to 4 microocculomb . sec (at a counting efficiency of 50%). The data obtained by oscillographs showed that the

Card 2/3

SOV/48-22-8-18/20
Industrial Photoelectronic Multipliers With an Improved Time Resolution and
Strong Output Currents

pulse rise times approximately equal from 2,5 to 3 micro-
coulomb.sec and their general resolution is somewhat above
10 microcoulomb.sec (Fig 5).

There are 5 figures and 1 reference, which is Soviet.

Card 3/3

SOV/48-22-8-19/20

AUTHORS: Berkovskiy, A. G., Breydo, I. Ya., Glukhovskiy, B. M.,
Korol'kova, O. S., Leyteyzen, L. G., Tarasova, Ye. I.

TITLE: Data Concerning Industrial Photoelectronic Multipliers for
Scintillation Spectrometers (Novyye dannyye o promyshlennyykh
tipakh fotoelektronnykh umnozhitel' dlya stsintillyatsionnykh
spektrometrov)

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1958,
Vol.22, Nr 8, pp. 1005 - 1008 (USSR)

ABSTRACT: At the 7th All Union Conference on Nuclear Spectroscopy the
basic features of new FEU (photoelectronic multiplier - FEM)
types for spectrometry were communicated (Ref 1). In this paper
the authors give new data on earlier developed FEM types, which
are already in industrial production, and on new FEM's the
development of which was terminated in 1957. In that year the
mass production of the basic type of the spectrometers, the
FEM-29 was started. As a result of the investigations, the
types were arranged according to the voltages in the first
cascades of the multipliers which guarantee a good amplitude

Card 1/3

Data Concerning Industrial Photoelectronic Multipliers for Scintillation Spectrometers

SOV/48-22-6-19/20

resolution. As the problem arose whether it would be possible to produce spectrometers FEM with a better resolution, it was attempted to produce spectrometers FEM with multialkali cathodes (as, for example Sb-Na-K- or Sb-Na-K-Cs cathodes) (In figure 3 the characteristics of these cathodes are given). The FEM-24 went into series production in the last year (Ref 1). The authors carried out experiments with good prospects with a multiplying system with toroidal dynodes of Al-Mg-alloys. One of the new types of midget spectrometers FEM is described as follows: cathode diameter 25 mm, maximum socket diameter 34,5 mm, length 110 mm. For practical operation the multiplier is equipped with a high-resistance potentiometer. From the table can be seen that the resolution of these multipliers is of the same order as that of FEM-29. The basic features of the design of the FEM-31 are given in reference 3. The spectrometric resolution of the FEM-31 which was measured with a crystal with a diameter of 14 mm was within the limits of 8,5 - 11%. An FEM with a large cathode (diameter 300 mm) was developed for work with liquid synthetic scintillators. (Antimony-cesium cathode

Card 2/3

SOV/48-22-8-19/20
Data Concerning Industrial Photoelectronic Multipliers for Scintillation Spectrometers

with a sensitivity better than $20 \mu A \text{ lm}^{-1}$, multiplier sensitivity at 2400 V better than $10 A \text{ lm}^{-1}$, toroidal dynodes of AMg K alloy). An FEM with a bismuth-silver-cesium cathode was described in reference 3. These multipliers give a good amplification. The amplitude resolution of 10 specimens of FEM with NaJ-(Tl)-crystal with a diameter of 20 mm and with

Cs^{137} was within the limits of 12 - 14%.

There are 5 figures, 1 table, and 3 references which are Soviet.

Card 3/3

BERKOVSKIY, A. G., Candidate Tech Sci (diss) -- "photoelectronic multipliers for investigating time-correlated processes". Moscow, 1959. 16 pp (Min Higher Educ USSR, Moscow Order of Lenin Power Engineering Inst), 150 copies (KL, No 24, 1959, 134)

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9.4/30(2201, 2301, 2801, 3001, 2104)

S/109/60/005/009/027/030/XX
E032/E514

AUTHORS: Berkovskiy, A. G. and Pol'skiy, V. G.

TITLE: A Study of the Time Resolution of Photomultipliers²⁵ Using the Oscillographic Method

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol.5, No.9,
pp.1475-1477 + 1 plate

TEXT: A description is given of a method of measuring the time resolution of photomultipliers using a fast oscillograph and periodic light flashes of nanosecond duration. The oscillograph employed was described by Pol'skiy in Ref.1 and the light flashes were obtained by spark discharge. The flash repetition frequency was adjusted to a few hundreds of kc/s and the time base of the oscillograph was triggered by synchronizing pulses from the flash generator. For each photomultiplier optimum supply conditions were first determined, giving rise to the maximum pulse amplitude. The slope of the leading edge of anode pulses S and the amplitude of the pulses were measured. The length of the leading edge was defined as the 10%-90% rise. The slope S was defined as the amplitude of the pulse divided by the length of the leading edge (in units of mA/nanosec). Thirty ФЭУ-33 (FEU-33) photomultipliers were investigated. The Card 1/3

84942

S/109/60/005/009/027/030/XX
E032/E514

A Study of the Time Resolution of Photomultipliers Using the Oscillographic Method

maximum value of S was found to be 350 mA/nanosec. Other photomultipliers tested were two FEU-11 ($S = 20$ and 100 mA/nanosec, respectively), one FEU-13 ($S = 150-200$ mA/nanosec) and RCA 6810A ($S = 200$ mA/nanosec). In the case of the FEU-33 photomultipliers, the amplitude was found to lie between 0.3 and 1.1 A and in 75% of them the amplitudes were between 0.4 and 0.8 A. The output pulse amplitudes for the other photomultipliers were roughly within the same limits. The measured pulse length t_p (measured at the base of the pulse) was found to be: 20 nanosec (FEU-33), 100 nanosec (FEU-11), 40 nanosec (FEU-13), 30 nanosec (RCA-6810A), 20 nanosec (RCA-6342) and 6-9 nanosec (special photomultiplier with time spread compensation). In the latter case the leading edge slope was found to be 400 mA/nanosec on the average. The spread in the transit times of photoelectrons was measured by illuminating the central part of the cathode (diameter 5 mm) and then using special screens with narrow annular apertures, the peripheral parts of the cathode. The results obtained for the time spread are summarised

Card 2/3

84942

S/109/60/005/009/027/030/XX
E032/E514

A Study of the Time Resolution of Photomultipliers Using the
Oscillographic Method
in the following table:

Type FEU	$\Delta T_{r_i - r_o}$, nanosec		
	$r = 14 \text{ mm}$	$r = 17.5 \text{ mm}$	$r = 21 \text{ mm}$
FEU-33	2-3.5	-	-
FEU-11	1.0	4.0	-
FEU-13	1.2	3.5-5.5	4.5
RCA-6810A	2	4	6.5
RCA-6342	2	2.5	5.5
FEU with time spread compensation	1.0	1.6	3

The photograph facing p.1476 shows oscillograms of the output pulses
(a - calibrating signal, $T = 9$ nanosec; b - photomultiplier with time
spread compensation; c - FEU-13; d - FEU-11). Acknowledgments are
expressed to V. K. Voytovetskiy for advice and discussions.
There are 1 figure, 1 table and 1 Soviet reference.
SUBMITTED: December 2, 1959
Card 3/3

85863

9.8/50 (3002,3203)

S/O48/59/023/012/008/009
B006/B060

AUTHORS: Berkovskiy, A. G., Breydo, I. Ya., Korol'kova, O. S.,
Leyteyzen, L. G.

TITLE: Some Characteristics of New Photoelectronic Multipliers

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959,
Vol. 23, No. 12, pp. 1517 - 1519

TEXT: Two new types of photoelectronic multipliers $\Phi\Delta Y$ -35 (FEU-35) and $\Phi\Delta Y$ -29 (FEU-29), as applied to scintillation spectrometers, were worked out by the authors. Full particulars are given of FEU-35, less of FEU-29. The cathode diameter of FEU-35 is 25 and 34 mm for 108 mm length. To improve electron-optical properties of the input a focusing cylinder (cf. Fig.1) is applied. This cylinder permits better combination between the axial-symmetric inlet of the multiplier and the inevitably asymmetrical first cascade of the multiplier system. The new inlet system secures a good energy resolution. As much as 600 FEU-35 devices were checked for amplitude resolution (Fig.2) and for the amount of the energetic noise equivalent (Fig.3). Fig.4 illustrates the average

Card 1/3

Some Characteristics of New Photoelectronic Multipliers

85863

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B006/B060

amplification and the sensitivity of the multiplier as well as the dependence of the dark current on the supply voltage. The linear dependence of the output signal amplitude on the γ -quantum energy is secured up to amplitudes of the magnitude 10 v for 50 k Ω and 10 pF. The sensitivity threshold is about $(6-8) \cdot 10^{-12}$ lm for a resonance amplifier band width of 20 cycles and for a resonance frequency of 80 cycles. The second multiplier (FEU-29) suitable for γ -spectrometry has a cathode with the dimensions 38.48.190 mm. Its amplitude resolution is given with 7.5 - 10%. It exhibits an especially low noise level (1 - 2 kev) in the 50 imp/sec level. To test the stability of the photoelectronic multipliers under work conditions, a special device was constructed, permitting measurement of the change with time of the Cs¹³⁷ photopeak level by means of a NaJ(Tl)-crystal. This device consisting mainly of a one-channel analyzer is described. Fig. 5 presents the photo of one part of the record chart of the photopeak amplitude stability of Cs¹³⁷ for 4 FEU-29 multipliers. The horizontal multiplying factor was 0.4% of the pulse amplitude, the vertical one was 30 minutes. Displacement with


Card 2/3

85863

Some Characteristics of New Photoelectronic
Multipliers

S/048/59/023/012/008/009
B006/B060

time of the averaged photopeak amplitude as well as variations of the
amount of amplitude through an average value may be recorded by this
method. The last mentioned effect was between 0.3 and 1%. There are
5 figures.



Card 3/3

S/048/60/024/03/19/019
B006/B014

AUTHORS: Berkovskiy, A. G., Pol'skiy, V. G.

TITLE: Dependence of the Amplification of Photoelectronic
Multipliers on the Amplitude of Pulses and the Time
Intervals Between Them

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960,
Vol. 24, No. 3, pp. 377-379

TEXT: The article under review was read at the Tenth All-Union Conference of Nuclear Spectroscopy (Moscow, January 19 - 27, 1960). The dependence of the amplification of photomultipliers on the mode of pulse operation leads to considerable difficulties in the case of certain energy measurements. In order to be able to estimate the errors arising within a large range of the counting rate, the authors developed a special apparatus to be used for the investigation of photomultipliers (above all, such of the type FEU-33). Fig. 1 shows the principal circuit diagram of the apparatus, which is described by way of introduction. The

Card 1/2

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Dependence of the Amplification of
Photoelectronic Multipliers on the
Amplitude of Pulses and the Time Intervals
Between Them

S/048/60/024/03/19/019
B006/B014

apparatus used an IO-4 oscilloscope. A special quick oscilloscope (Ref. 4) had to be employed for investigations in the range of nanoseconds. The dependence of the amplitudes of the "second" pulses on the time interval between pulses was investigated on the types: FEU-33⁸ (30 units), FEU-11²⁴ (2 units), FEU-13¹⁰ (2 units), RSA-6810A⁶ (1 unit), and RSA-6342⁴ (3 units). The feed voltage was 3 - 4 kv. No relationship between amplitude and time interval was found on FEU-11 and FEU-13, whereas it was very strong in the case of RSA-6810A and RSA-6342. Fig. 2 shows the amplification coefficient as a function of the time interval between two pulses. FEU-33 had a recovery time ≤ 3 , which was between 15 and 20 μ sec in the case of RSA multipliers. The same instrument also served to investigate the dependence of the amplitudes of the "second" pulse on those of the "first" pulse at time intervals of between 0.1 and 2.5 μ sec. Results obtained for an FEU-33 multiplier are shown in Fig. 3. With widening amplitude of the "first" pulse, the amplitude of the "second" decreases. The slopes of curves may vary greatly from one photomultiplier to another. There are 3 figures and 4 references, 1 of which is Soviet.

Card 2/2

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28534

9.3140 (also 1140, 1141, 3902)

S/109/61/006/009/017/018
D201/D302

AUTHORS: Berkovskiy, A.G., and Tszya Gao

TITLE: Electron focusing in a cathode system of photo-electro-
multipliers with semi-transparent cathodes

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 9, 1961,
1588 - 1590

TEXT: In the present article the authors present certain analytical and experimental data on the electron optical properties of photomultipliers. The authors state that in their opinion the electron optical (focusing) properties of a system in Fig. 1 are determined by two dimensionless parameters $p = D/d$ and $q = D/h$, where D - the diameter of the cup; d - diameter of the photoelectron beam in the plane of diaphragm (the diameter of the input window of the diaphragm); h - distance between the plane of the cathode and that of the diaphragm. In designing a photomultiplier, p_1 and hence q_1 is given. The function $p = f(q)$ can be determined from an electro-
Card 1/5

Electron focusing in a cathode ...

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S/109/61/006/009/017/018
D201/D302

lytic tank analogue of a system with different q 's and by determining d in every variant from the electron trajectories. The authors used such a model in the shape of a cup, whose bottom was the cathode and the moving lid represented the diaphragm. The electrodes were made from stainless steel. The inner cup diameter was 20 cm. Since the diameter of the working surface of the cathode is usually slightly smaller than D , the cathode diameter was chosen $D_k = 0.8D$. The function $p = f(q)$ was found for two cases (Fig. 3). Curve 1 - photoelectrons emitted with zero initial velocity $v_0 = 0$, curve 2 - $v_0 = 0.4$ volts; emission angle 45° . Curve 1 is of interest only for large field intensities near the cathode, a condition seldom met in practice and it can be approximated by an empirically found formula

$$p = 1 + 1902 (q - 0.7)^{1.96} e^{7.35(q-0.7)},$$

whose graph is shown by the broken line. Curve 2 is nearer to the real working conditions of a photomultiplier. For this curve $q_{opt} \approx 1.1$. For $q < 1$ the field intensity of the emitting surface is so

Card 2/5

Electron focusing in a cathode ...

25531
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D201/D302

small that the electron emitted from the ends of the cathode at 45° reach the cup which means that the effective working diameter of the cathode is smaller than the chosen one. Comparison of curves 1 and 2 shows that the assumed values of the initial velocity increase about 2 times the diameter of the photoelectrons in the plane of the diaphragm. There are 3 figures and 3 references: 1 Soviet-bloc and 2 non-Soviet-bloc.

SUBMITTED: January 28, 1961

✓X

Card 3/5

BERKOVSKIY, A. G.
AID Nr 976-13 H.G.
24 May

PHOTOMULTIPLIER WITH HIGH TIME RESOLUTION (USSR)

Berkovskiy, A. G. Radiotekhnika i elektronika, v. 8, no. 4, Apr 1963,
709-712. S/109/63/008/004/023/030

In order to reduce the time scattering of photoelectrons from the cathode in the 66Y-36 photomultiplier, the inner surface of the cathode glass is made spherical, and the accelerating electrodes are positioned between the diaphragm and the cathode. The diaphragm potential is applied to the first focusing cylinder, and the second cylinder is connected to the third dynode inside the bulb. The beveled edges of the cylinders, directed toward the diaphragm, produce a small lateral photoelectron shift which improves the collection of secondary electrons from the first dynode. The input stage of the 66Y-36 uses an electron mirror and an accelerator grid. The electron mirror reduces pulse duration by 20% and increases

Card 1/2

PHOTOMULTIPLIER [Cont'd]

S/109/63/008/004/023/030

pulse front steepness by 30% as compared to multipliers which use conventional input stages. In addition, single-stage time-scattering compensation was introduced, resulting in further improvements of time characteristics. By proper selection of the angle between the dynodes and grids, the time scattering per stage can be made extremely small. Calculations based on the results of modelling the $\Phi\Phi Y-36$ in an electrolytic bath show that transit-time scattering for electrons with initial zero velocities is ≤ 0.1 nsec. An antimony-cesium cathode is used in the $\Phi\Phi Y-36$. The range of its spectral density is 3000-6000 Å with a maximum in the vicinity of 4000 ± 200 Å. The minimum integral sensitivity of the cathode subjected to strobing from a source with a color temperature of 2854°K is equal to 30 μ amp/lm.

[KM]

Card 2/2

L 11118-63

EWI(1)/EDS AFFTC/ASD

ACCESSION NR: AP3003699

8/0048/63/027/007/0932/0936

AUTHOR: Berkovskiy, A. G.; Gusel'nikov, V. G.; Shapovalov, P. Ye.

TITLE: Photomultipliers with toroidal emitters [XIII yezhegodnoye soveshchaniye po yadernoy spektroskopii (XIII Annual Conference on Nuclear Spectroscopy) held in Kiev from 25 January to 2 February 1963]

SOURCE: AN SSSR. Izv. Seriya fizicheskaya, v. 27, no. 7, 1963, 932-936

TOPIC TAGS: multiplier, secondary emission, toroidal emitter

ABSTRACT: A series of photomultipliers utilizing a toroidal multiplying system with 14 amplification stages has been developed. The multiplying system contains no accelerating grids, which results (at a stage voltage of 250 v) in a maximum secondary-electron transit-time spread of 0.95 nanosec from external to internal emitter and 0.81 nanosec from internal to external. Photomultipliers with three sizes of cathode, 50, 100, and 150 mm in diameter, were constructed; the cathodes were made of an Sb-Cs alloy and the emitters of an Al-Mg-Si alloy. Experiments showed that the plate sensitivity of the instruments with 50-mm cathodes is greater than that of the other two types; the gain of the former is approximately 10^8 , while that of the latter is approximately 10^6 . Toroidal

Card 1/2

L 11118-63

ACCESSION NR: AP3003699

multiplying systems are said to have the following advantages over other systems: 1) larger area of the input aperture of the diaphragm, which facilitates photoelectron collection on the first emitter; 2) larger working emitter surface than other types of devices of the same size; 3) absence of sharp edges, which at higher power-supply voltages lead to the occurrence of an autoelectronic component of the dark current; and 4) positioning of all the bracketing insulators, which are one possible cause of unstable photomultiplier operation, on the outside of the transit space. Orig. art. has: 5 figures and 2 tables.

ASSOCIATION: none

SUBMITTED: 00

DATE ACQ: 02Aug63

ENCL: 00

SUB CODE: GE,SD

NO REF SOV: 003

OTHER: 001

Card 2/2

L 11301-63 EEC(b)-2/RDS--AFFTC/ASD
ACCESSION NR: AP3003700

S/0048/63/027/007 0037/0039

AUTHOR: Berkovskiy, A. G.; Filimonova, T. A.

TITLE: New miniature photomultipliers [Report of the 13th Annual Conference on Nuclear Spectroscopy, held in Kiev, 25 Jan-2 Feb 1963]

SOURCE: AN SSSR. Izv. Seriya fizicheskaya, v. 27, no. 7, 1963, 937-939

TOPIC TAGS: photomultiplier, antimony-cesium cathode, dosimeter, scintillation counter, box-type multiplier

ABSTRACT: The FEU-60 photomultiplier, designed for use as an intracavity-type scintillation counter in medical dosimetric equipment, is described. Because of the small dimensions of the FEU-60 (external diameter 15 mm; cathode diameter 10 mm) it may also be utilized in other portable equipment. The photomultiplier is provided with special baffle-plate screens, which are extensions of the emitter working surface (see Fig. 1 of Enclosure). Due to the elimination of a through gap (in grid-type box systems where optical and ionic feedback can appear) and the elimination of welded grids, the operation of the FEU-60 is stable even at high voltages. The system consists of 10 antimony-cesium emitters. During measurements, an incandescent lamp with a color temperature of 2854K was used.

Card 1/32

L 11301-63

ACCESSION NR: AP3003700

Minimum anode sensitivity is 30 $\mu\text{amp/lumen}^{-1}$ at an amplification of 10^6 , and can be achieved at voltages which do not exceed 1600 v. Orig. art. has: 4 figures. 0

ASSOCIATION: none

SUBMITTED: 00

DATE ACQ: 02Aug63

ENCL: 01

SUB CODE: SD

NO REF SOV: 004

OTHER: 000

Card

2/52

- 6 (2/55) -

"APPROVED FOR RELEASE: 06/08/2000

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END PAGE: 20

APPROVED FOR RELEASE: 06/08/2000

CIA-RDP86-00513R000204930002-1"

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BERKOVSKIY, A.G.; GUSEL'NIKOV, V.G.; DUKOR, S.G.

Parameters of photoelectronic multipliers with toroidal emitters
and a cathode diameter of 50 mm. Izv. AN SSSR Ser. fiz. 29 no.2:
331 333 F '65. (MIRA 18:3)

SOBOLEVA, Nina Aleksandrovna; BERKOVSKIY, Arkadiy Grigor'yevich;
CHECHIK, Noson Osherovich; YELISEYEV, Rayngol'd
Yevgen'yevich; ZERNOV, D.V., red.; CHEBOTAREVA, A.V., red.

[Photoelectronic instruments] Fotoelektronnye pribory. Mo-
skva, Nauka, 1965. 592 p. (MIRA 18:12)

BERKOVSKIY, A.G., inzh.

"Start-Pilot" equipment for speedy starting of engines
under cold weather conditions. Transp.stroi. 14 no.12:
54-55 D '64. (MIRA 19:1)

BERKOVSKIY, A.G.; GUSEL'NIKOV, V.G.; ONUCHIN, A.P.

Photoelectric multiplier with toroidal emitters (FEU-30).
Prib. i tekhn. eksp. 10 no. 5: 201-204 S-O '65.

(MIRA 19:1)

ACC NR: AP6013512

UR/0120/66/000/002/0123/0128

AUTHOR: Berkovskiy, A.G.; Gusel'nikov, V.G.; Pankratov, V.M.

ORG: Moscow Electric Lamp Works (Moskovskiy elektrolampovyy zavod)

TITLE: Photoelectric multipliers with large diameter cathodes and a toroidal multiplication system

SOURCE: Priory i tekhnika eksperimenta, no. 2, 1966, 123-128

TOPIC TAGS: photomultiplier,
toroidal multiplier photomultiplier, photomultiplier design/FEU-65
photomultiplier, FEU-63 photomultiplier

ABSTRACT: Design features and performance characteristics of improved photomultipliers are discussed. These photomultipliers, with large cathode diameters and toroidal shape multiplication systems are represented by the recently introduced production models FEU-63 (cathode dia. 100 mm) and FEU-65 (cathode diameter 150 mm). Design approach, constructional details, characteristics and results of tests are presented. The toroidally shaped multiplication system comprises emitters, potential shaping surfaces etc, generated by rotation of suitable profiles around the enclosure axis. With the electrostatic system of focusing used, this approach has the advantages of 1) large working surface, 2) absence of sharp corners and edges generating dark autoelectronic currents; 3) absence of electron dissipation 4) absence of structural members in the electron path 5) rigidity and 6) a large area of the diaphragm entrance. During the design stage, the emitter and screen profiles were modeled in an electrolytic analog bath and on electronic trajectograph. The cathode integral sensitivity is around 40 - 55 $\mu\text{a/lu}$. The maximum dark currents at an anode sensitivity of 1000 a/lm

Card 1/2

UDC: 621.383.533

ACC NR: AP6013512

are 50 - 100 μ a. Uncertainties in thru-flight time were under 1 nsec. The time resolution for two tested FEU-65's was 3 nsec. The very good performance of these photomultipliers permits their use in certain nuclear physics research projects. They have a high time resolving power (several nanoseconds), a high amplification factor (around 10^8), and a wide range of output signal linearity (up to 1 a). Orig. art. has 6 figures and 1 table.

SUB CODE: 09 /

SUBM DATE: 12Mar65 /

ORIG REF: 005 /

OTH REF: 002

Cord 2/2

ACCESSION NR: AR4042178

8/0272/64/000/005/0182/0183

SOURCE: Ref. zh. Metrologiya i izmerit. tekhn. Otd. vy'p., Abs. 5.32.1170

AUTHOR: Leyteyzen, L. G.; Glukhovskiy, B. M.; Berkovskiy, A. G.

TITLE: Characteristics of new types of multistage photomultipliers for scintillation spectrometers

CITED SOURCE: Sb. Stsintillyatory' i stsintillyats. materialy*. Khar'kov, Khar'kovsk. un-t, 1963, 217-220

TOPIC TAGS: scintillation spectrometer, spectrometer, scintillation counter, photomultiplier, multistage photomultiplier

TRANSLATION: In 1960 there were developed new types of multistage photomultipliers, which will be used in scintillation counters and spectrometers. The main characteristic of the new types of photomultipliers is the wide wavelength interval in which their photocathodes are sensitive: antimony-caesium (FEU-37), antimony-caesium with quartz window (FEU-39), multi-alkali (FEU-38 and FEU-51). Spectral responses of these photomultipliers are given. Three illustrations. Bibliography: 1

SUB CODE: EM, OP

ENCL: 00

Card

1/1

ACC NR: AP5027034

SOURCE CODE: UR/0120/65/000/005/0201/0204

AUTHOR: ^{44, 51} Berkovskiy, A. G.; ^{44, 51} Gusel'nikov, V. G.; ^{44, 51} Onuchin, A. P.

ORG: Moscow Electric Lamp Plant (Moskovskiy elektrolampovyy zavod)

TITLE: ^{20, 44, 51} Photomultiplier with toroidal emitters (FEU-30)

SOURCE: Pribory i tekhnika eksperimenta, no. 5, 1965, 201-204

TOPIC TAGS: photomultiplier, photomultiplier tube, photoelectric detection system

ABSTRACT: A new photomultiplier tube, designated the FEU-30, is described. The principal feature is the bucket-shaped toroidal dynode and associated reflecting screen used in the multiplier stages (see Fig. 1). This configuration has several

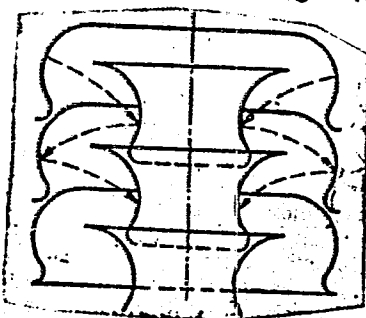


Fig. 1. Multiplier stages

Cord 1/2

UDC: 621.383.292

L 1419-66

ACC NR. AP5027034

advantages over conventional dynode designs, including maximum emitting surface per volume, large input aperture to the first stage, and absence of edge scatter in the electron beam. The 14 dynode elements are mounted and spaced by glass supports in an envelope 67 mm in diameter and 180 mm long. The dynodes are constructed of an Al-Mg alloy; the photocathode is Cs-Sb. The FEU-30 responds to the 3500—6000 Å region and at an operating voltage of 3—3.5 kv attains a multiplication factor of 10^9 . Some circuit details and a calibrating technique are included in the discussion. [SH]

Orig. art. has: 3 figures and 1 table.

SUB CODE: EC/ SUBM DATE: 14Jul64/ ORIG REF: 001/ CTH REF: 000/ ATD PRESS: 4/25

Card 2/2

Berkovskiy, A. M.

AID P - 2433

Subject : USSR/Electricity

Card 1/1 Pub. 26 - 32/33

Author : Berkovskiy, A. M.

Title : Use of selenium rectifiers in excitation circuits of large synchronous motors

Periodical : Elek sta 5, 62, My 1955

Abstract : The system of excitation of circuits with selenium rectifiers recommended by the Allis-Chalmers Co. is described in detail. One drawing and 1 diagram. Two 1954 American references.

Institution: None

Submitted : No date

BERKOVSKIY, A. M.

AID P - 2831

Subject : USSR/Electricity
Card 1/1 Pub. 27 - 20/30
Author : Berkovskiy, A. M., Eng.
Title : ~~Turbogenerators~~ Turbogenerators with interior cooling of operating parts. (Review of foreign periodicals)
Periodical : Elektrichestvo, 6, 77-79, Je 1955
Abstract : The author gives a summary of the development of turbogenerators in the USA during the last 25 years. He then gives some data about interior cooling of stator and rotor windings from Allis-Chalmers, Westinghouse Electric and General Electric material. Five drawings, 12 references (1946-1954).
Institution : None
Submitted : No date

BERKOVSKIY, A. M.

AID P - 3264

Subject : USSR/Electricity
Card 1/1 Pub. 27 - 19/25
Author : Berkovskiy, A. M., Eng.
Title : European production of turbogenerators with internal hydrogen cooling of windings, (review of foreign periodicals)
Periodical : Elektrichestvo, 9, 81, S 1955
Abstract : The author summarizes three articles on this subject which appeared in German periodicals and in a report from the International Conference of the Principal High-Tension Electrical Systems. Three drawings, 1 photograph, 3 references, 1954.
Institution : None
Submitted : No date

BERKOVSKIY, A.M., inzhener; KRAYZ, A.G., inzhener.

~~Maximum capacities in future power supply development in the~~
German Federal Republic. Elektrichestvo no.7:87-92 J1 '56.
(MLRA 9:10)

(Germany, West--Electric power) (Germany, West--Power engineering)

BERKOVSKIY, A.M.inzhener.

Increasing the capacity of operating synchronous generators (from
CIGRE, report 132, 1956) Elektrichestvo no.2:91-92 P '57.
(MLRA 10:3)

(Electric generators)

PA - 3117

AUTHOR:

- 1.) Engineer BERKOVSKIY, A.M.
- 2.) Candidate of technical science GALONEN, YU. M.
- 3.) Engineer KRAYZ, A. G.

TITLE:

- 1.) The Operation of Turbogenerators with Hydrogen Cooling.
(Rezhimy ekspluatatsii turbogeneratorov s vodorodnym okhla-
zheniyem. Russian).
- 2.) Municipal Rail Electrotransport Undertakings Abroad.
(Gorodskoy rel'sovyy elektrottransport za rubezhom. Russian)
- 3.) Gasfilled Transformers.
(Gazonapolnennyye transformatory. Russian).

PERIODICAL:

Elektrichestvo, 1957, Nr 5, pp 83 - 90 (U.S.S.R.)
Received: 6 / 1957
Reviewed: 7 / 1957

ABSTRACT:

- 1.) A general survey and a special description of the research done by General Electric of the U.S.A. and Al'st of France (with 5 illustrations, 1 table).
- 2.) The present condition of subways and streetcars according to foreign models of the last four years and the new types of high speed railways in the U.S.A. and London (with 2 illustrations and 5 tables).
- 3.) A general survey and description of the transformer produced by General Electric, which has 2000 KVA on 69 KVA with 140 % transformation in 8 hours. From G. Camilli, General Electric

Card 1/2

PA - 3117

- 1.) The Operation of Turbogenerators with Hydrogen Cooling.
- 2.) Municipal Rail Electrotransport Undertakings Abroad.
- 3.) Gasfilled Transformers.

Review, 1956, Nr 3 - 4, p 41 (with 3 illustrations and 1 table).

ASSOCIATION: Not given

PRESENTED BY:

SUBMITTED:

AVAILABLE: Library of Congress

Card 2/2

BERKOVSKIY, A.M., inzhener.

Liquid cooling of turbogenerators. Elektrichestvo no.10:84-86
0 '57. (MLRA 10:9)

(Turbogenerators)

BERKOVSKIY, A.M.
BERKOVSKIY, A.M., inzh.

Increasing the overload capacity of transformers by the method
of cooling them. Elektrichestvo no.12:81-82 D '57. (MIRA 10:12)
(Electric transformers)

8 (0)

SOV/112-59-1-41

Translation from: Referativnyy zhurnal. Elektrotehnika, 1959, Nr 1,
pp 3-4 (USSR)

AUTHOR: Berkovskiy, A. M., and Grinshpun, P. K.

TITLE: Mastering the Production of Electrical Equipment

PERIODICAL: V sb.: Energ. str-vo SSSR za 40 let. M.-L., Gosenergoizdat,
1958, pp 331-339

ABSTRACT: Bibliographic entry.

Card 1/1

HERKOVSKIY, A.M., inzh.

Cooling of turbogenerators on account of latent heat of vaporization.
Energekhoz. za rub. no.5:46-47 S-O '58. (MIRA 11:12)
(Canada--Turbogenerators--Cooling)

▲VERBAKH, D.A., insh.; BERKOVSKIY, A.M., insh.

Tendencies in the building of control panels in the Federal
Republic of Germany. Energokhoz. za rub. no. 6:27-34 N-D '58.
(MIRA 12:4)

(Germany, West--Electric controllers)

8(5)

AUTHOR: Berkovskiy, A. M., Engineer

SOV/105-58-11-22/28

TITLE: New Exciter Systems for Alternators (Novyye sistemy возбuzhdeniya sinkhronnykh generatorov)

PERIODICAL: Elektrichestvo, 1958, Nr 11, pp 88-90 (USSR)

ABSTRACT: This is a review of the two patents:

- 1) USA, Nr 2, 773 233, 04.12.56, Marcks, Donald F., Westinghouse El. Corp.
- 2) German Federal Republic, patent Nr 962912, 02.05.57, Locher und Söhne G.m.b.H. There are 4 figures and 2 references,

Card 1/1

BERKOVSKIY, A.M., inzh.

Shunting capacitors in U.S. distributive networks. Energokhoz. za
rub. no.6:24-30 N-D '59. (MIRA 13:3)

(United States--Electric power distribution)
(Electric capacitors)

BERKOVSKIY, A.M., inzh.

Stalingrad Hydroelectric Power Station supplying electric
power for the Donets Basin. Nauka i zhizn' 27. no.2:17-21
F '60. (MIRA 13:6)

1. Institut "Teploelektroproyekt."
(Electric power distribution)

BERKOVSKIY, A.M., inzh.

Reducing cable communication costs with a decentralized system of control, signalization and protection of substations. Energokhoz. za rub. no.3:28-32 My-Je '60. (MIRA 13:7)
(Electric power distribution—Communication systems)

BERKOVSKIY, A.M., inzh.

Turbogenerators with limited power output. Energokhoz. za rub. no.4:
18-30 J1-Ag '60. (MIRA 13:10)
(Turbogenerators)

AVERBAKH, D.L.; BERKOVSKIY, A.M.

Using gas turbines in electric power plants. Biul.tekh.-ekon.
inform. no.11:89-95 '60. (NIRA 13:11)
(Electric power plants) (Gas turbines)

BERKOVSKIY, A.M.

Direct-current transmission lines. Biul.tekh.-ekon.inform.
no.5:87-92 '61. (MIRA 14:6)
(Electric lines)

BERKOVSKIY, A.M.

Modern turbogenerator industry in capitalist countries. Biul.
tekh.-ekon.inform. no.12:90-93 '61. (MIRA 14:12)
(Turbogenerators)

BERKOVSKIY, A. M.

Development of power systems and the creation of unified
high-voltage networks in capitalist countries. Biul.tekh.-
ekon.inform.Gos.nauch.-issl.inst.nauch. i tekhn.inform.
no.10:87-92 '62. (MIRA 15:10)

(Electric power distribution)

AVERBAKH, D.L.; BERKOVSKIY, A.M.

Mobile electric power plants abroad. Biul.tekh.-ekon.inform.Gos.-
nauch.-issl.inst.nauch.i tekh.inform. no.11:97-100 '62.

(Electric power plants)

(MIRA 15:11)

BERKOVSKIY, A.M.

Present state of the developments in the use of superconductors in
electric power engineering. Biul.tekh.-ekon.inform.Gos.nauch.-
issl.inst.nauch.i tekh.inform. 16 no.7:80-84 '63. (MIRA 16:8)
(Electric conductors)

I 08506-67 EWT(1)/EEC(k)-2 LJP(c) AT
ACC NR: AM6016147

Monograph

Soboleva, Nina Aleksandrovna; Berkovskiy, Arkadiy Grigor'yevich; Chechik, Noson Osherovich; Yeliseyev, Reynol'd Yevgen'yevich

UR/ 57
56
B+1

Photoelectronic devices (Fotoelektronnyye pribory) Moscow, Izd-vo "nauka", 65.
0592 p. illus., bibio., index. 11,000 copies printed.

Series note: Fiziko-matematicheskaya biblioteka inzhenera

TOPIC TAGS: photoelectric cell, photoconductive cell, photoelectric effect, photoelectron multiplier, photodiode, phototransistor

PURPOSE AND COVERAGE: The book presents basic information on the present state of physics of electronic processes occurring in photoelectronic devices, and describes the design, parameters, and characteristics of these devices. The book is intended for engineers and scientific personnel developing and using photoelectronic devices, and for graduate and undergraduate students at corresponding departments of institutions of higher learning.

TABLE OF CONTENTS (abridged):

Foreword -- 5

Ch. I. Introduction -- 7

Card 1/2

UDC621.383.4

L 08506-67

ACC NR:

AM6016147

- Ch. II. Physical principles of photoelectric effect -- 27
- Ch. III. Photomissive cells -- 102
- Ch. IV. Photomultipliers -- 203
- Ch. V. Photoconductive cells -- 392
- Ch. VI. Barrier-layer cells -- 483
- Ch. VII. Photodiodes and phototransistors -- 557
- Bibliography -- 588
- Subject index -- 589

SUB CODE: 09 SUBM DATE: 20Nov65/ ORIG REF: 154/ OTH REF: 090

Card 2/2 afs

BERKOVSKIY, B.

The Soviet Radio during the Years of the Great Patriotic War. Radio Engineering,
#5:11:May 55

BERKOVSKI, B.

A new form for the popularization of radiotechnical knowledge. Radio
i televizija 11 no.11:351 '62.

12118-65 EWT(d)/EWT(1)/EWP(m)/EWA(d)/ETG(m)/EWA(1) LJP(c) WH/GS
 ACC NR: AT6001770 SOURCE CODE: UR/0000/65/000/000/0151/0163

AUTHOR: Berkovskiy, B.; Shul'man, Z.

ORG: None

53

B+1

TITLE: Exact solutions of the boundary layer equations for pseudo-plastic fluids on a porous flat plate near the critical point

SOURCE: AN BSSR. Institut teplo- i massoobmena. Voprosy nestatsionarnogo perenosa tepla i massy (Problems of nonstationary heat and mass transfer). Minsk, Nauka i tekhnika, 1965, 151-163

TOPIC TAGS: boundary layer theory, fluid property, critical point, flat plate

ABSTRACT: The article considers the case of the boundary layer on a plate in a steady state homogeneous external stream. The velocity of the current is designated as U_{∞} . The x axis is directed along the plate, and the y axis is perpendicular to it. The equations of motion are then:

$$u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = \eta \frac{k}{\rho} \left| \frac{\partial u}{\partial y} \right|^{n-1} \frac{\partial^2 u}{\partial y^2},$$

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0. \quad (2)$$

Card 1/2

L 12118-66

ACC NR. AT6001770

The boundary conditions are:

$$\begin{aligned} u(x, 0) &= 0, \quad v(x, 0) = v_0 = ax^{-\frac{n}{1+n}}, \\ u(0, y) &= U_\infty, \quad \lim_{y \rightarrow \infty} u = U_\infty = \text{const.} \end{aligned} \quad (3)$$

The solution is sought in the form:

$$u = U_\infty \frac{dF}{d\eta} = U_\infty F'(\eta),$$

$$v = x^{-\frac{n}{1+n}} (\eta F' - F) \frac{1}{1+n} \left[n(1+n) \frac{k}{\rho} U_\infty^{2n-1} \right]^{\frac{1}{1+n}}, \quad (4)$$

$$\eta = yx^{-\frac{1}{1+n}} \left[\frac{U_\infty^{2-n} \rho}{nk(1+n)} \right]^{\frac{1}{1+n}}. \quad (5)$$

Following substitution of new variables, the article presents exact solutions of these equations, as well as of the equations for the boundary layer in the vicinity of the critical point. Orig. art. has: 21 formulas.

SUB CODE: 20/ SUBM DATE: 02Sep65/ ORIG REF: 002/ OTH REF: 006

Card

IVANOV, A.P.; STEPANOV, B.I.; BERKOVSKIY, B.M.; KATSEV, I.L.

Calculating the effect of inhomogeneities on the light regime of
a parallel-plate layer in nonlinear approximation. Dokl. AN BSSR
6 no.3:147-150 Mr '62. (MIRA 15:3)

1. Institut fiziki AN BSSR.

(Optics, Physical)

9.2576

42040
S/201/62/000/003/001/002
I045/I245

AUTHORS: Ivanov, A.P., Berkovskiy, B.M., and Katsev, I.L.

TITLE: Calculation of the emission of a light scattering layer by methods of non-linear optics

SOURCE: Izvestiya Akademii Nauk Belorusskoy SSR. Seriya, fiziko-tekhnicheskikh nauk. no.3. Minsk, 1962, 23-26

TEXT: The authors investigate by means of the Schwarzschild-Schuster method the propagation of radiation of strong intensity in a turbid, plane-parallel layer, in the case when the negative absorption coefficient depends on the intensity of the light field. Conditions for selfexcitation of the turbid layer and an expression

Card 1/2

S/210/62/000/003/001/002
I045/I245

Calculation of the emission of....

for the intensity of the generated light are derived. The generated intensity is given by

$$S_{emit} = -\frac{W}{2} = -\frac{k_0 l}{2\alpha} + \frac{\alpha(s l)^2 + b s l + c}{2\alpha s l} \quad (13) \text{ where}$$

W-absorbed energy per unit time; k_0 -absorption coefficient at the absence of light field; α -parameter of non-linearity ($\alpha \gg 0$); s-scattering constant; l-thickness of the scattering layer; a, b, c-constants depending on the reflexion coefficient r at the parallel boundaries of the scattering layer. Significant is the fact, that at $r = 0$ S_{emit} increases strongly with increasing sl, where as at $r \rightarrow 1$ it becomes a constant $\frac{k_0 l}{2}$ determining the maximum possible value of the generated intensity. At small r a slight increase of the light scattering substance within the turbid layer causes a transition from a non-excited to a selfexcited system. There are 3 figures.

Card 2/2

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37227
S/051/62/012/004/015/015
E039/E485

AUTHORS: Stepanov, B.I., Ivanov, A.P., Berkovskiy, B.M.,
Katsev, I.L.

TITLE: The transfer of radiation in a plane parallel layer
in the approximation of nonlinear optics

PERIODICAL: Optika i spektroskopiya, v.12, no.4, 1962, 533-536

TEXT: The problem of the transfer of radiation in a plane parallel layer is considered on the basis of equations for the transmission of radiant energy with a nonlinear dependence of the absorption coefficient for dense radiation. The calculations are for monochromatic radiation (flux S_0) propagated normal to the surface of a layer of thickness l . On account of multiple reflections between the boundary layers there will be two fluxes S_1 and S_2 in opposite directions at any point x in the layer. An expression for the absorption coefficient k is derived

$$k = \frac{k_0}{1 + \alpha(S_1 + S_2)} \quad (2)$$

where k_0 is the absorption coefficient in the absence of a
Card 1/3

The transfer of radiation ...

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light field and α the nonlinear parameter ($\alpha \geq 0$). The problem is only considered for a particular case which allows an easy analytical solution, namely by putting S_0 equal to zero. Equations are derived for the change in value of the absorption coefficient with position in the layer and its dependence on the reflectivity of the surface. The effect of a supplementary field of density u^* due to the thermal background is also considered and equations derived for the absorption coefficient k and the intensity of radiation $S_{\text{исп}}$ escaping from the layer.

$$k = \frac{k_0}{1 + avu^* + \alpha(S_1 + S_2)} \quad (16)$$

and

$$S_{\text{исп}} = \frac{(1 + avu^*) \ln r - k_0 l}{2\alpha} \quad (17)$$

where r is the coefficient of reflection and v is the velocity of light. It follows that the condition for radiation from the layer is

Card 2/3

The transfer of radiation ...

S/051/62/012/004/015/015
E039/E485

$$re^{-\frac{k_0 l}{1 + avu^*}} > 1$$

(18)

and that the presence of a supplementary field u^* displaces the self excitation limit in the region of greater $|k_0 l|$ or r .

SUBMITTED: December 30, 1961

Card 3/3

41311

S/170/62/005/010/004/009
B104/B186

AUTHORS: Ivanov, A. P., Berkovskiy, B. M., Katsev, I. L.

TITLE: Reflection and transmission of a plane-parallel layer in the scope of non-linear optics

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, v. 5, no. 10, 1962, 58 - 64

TEXT: The subject of investigation is a plate of thickness l and of small luminance characterized by the absorption coefficient k_0 and the reflection coefficient on the face r . A luminous flux S_0 is incident perpendicularly. Owing to multiple reflection there exist internally two kinds of flux at any point x : S_1 moving parallel to the incident flux, and S_2 moving in the opposite direction. These are described by the differential equations $dS_1 = -kS_1 dx$, $dS_2 = kS_2 dx$ (1) with the boundary conditions $S_1(x=0) = S_0(1 - r) + rS_2(x=0)$, $S_2(x=l) = rS_1(x=l)$ (2). The absorption coefficient can be expressed by $k = k_0/1 + \alpha(S_1 + S_2)$, where

Card 1/4

Reflection and transmission...

S/170/62/005/010/004/009
B104/B186

the parameters of non-linearity α and k_0 are assumed to be constant with respect to depth. The system (1) is solved by

$$\ln C_2 \alpha S_1 + \alpha S_1 - \frac{C_1}{\alpha S_1} = -k_0 x, \quad \ln \frac{\alpha S_2}{C_1 C_2} + \alpha S_2 - \frac{C_1}{\alpha S_2} = k_0 x. \quad (4)$$

and the relation $S_1 S_2 = C_1 / \alpha^2$ can be derived additionally from (1), stating that the product of two oppositely directed fluxes is constant at any depth. Hence the reflection coefficient R is obtained by

$$R = \frac{(1-r)C_1}{\alpha S_0 A} + r. \quad (8)$$

and the transmission factor T by

$$T = \frac{1-r}{\alpha S_0} \sqrt{\frac{C_1}{r}}. \quad (9).$$

On the basis of these formulas the light field was studied inside and outside the medium. For the region where k_0 is positive R and T are calculated by

$$R = r + \frac{(1-r)^2 r \exp(-2k_0 l)}{1 - r^2 \exp(-2k_0 l)}, \quad T = \frac{(1-r)^2 \exp(-k_0 l)}{1 - r^2 \exp(-2k_0 l)}. \quad (10)$$

Card 2/4

Reflection and transmission...

S/170/62/005/010/004/009
B104/B186

for the condition $\alpha S_0 \ll 1$, and by

$$R = \frac{2r}{1+r} - \frac{2r}{\alpha S_0(1+r)^2} k_0 l, \quad (11)$$

$$T = \frac{1-r}{1+r} - \frac{1}{\alpha S_0} k_0 l$$

for the condition $\alpha S_0 \gg 1$. For the region of negative values of k_0 ,

$$R = \frac{2\alpha S_0 k_0 l r - 2r(1-r)(\alpha S_0)^2 - r(k_0 l)^2}{\alpha S_0 [2k_0 l r - \alpha S_0 (1-r^2)]}, \quad (14)$$

$$T = \frac{(1-r^2) k_0 l \alpha S_0 - (1-r)^2 (\alpha S_0)^2 - r(k_0 l)^2}{\alpha S_0 [2k_0 l r - \alpha S_0 (1-r^2)]}$$

holds for high luminances. At high values of r the energy density distribution in the plate is virtually constant. At small values, this distribution has a minimum in the interior of the plate which vanishes if $r \rightarrow 1$. There are 4 figures.

ASSOCIATION: Institut fiziki AN BSSR, g. Minsk (Institute of Physics AS BSSR, Minsk)

Card 3/4

Reflection and transmission...

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SUBMITTED: January 13, 1962

Card 4/4

IVANOV, A.P.; BERKOVSKIY, B.M.; KATSEV, I.L.

Calculation of the radiation of a light-scattering layer within
the framework of nonlinear optics. Vestsi AN BSSR. Ser. fiz.-
tekh. nav. no.3:23-26 '62.
(MIRA 18:3)

SHUL'MAN, Z.P.; BERKOVSKIY, B.M.

Self-similarity problem of a laminar boundary layer on a permeable curvilinear surface. Inzh.-fiz. zhur. no.12: 125-126 D '63. (MIRA 17:2)

1. Institut teplo- i massoobmena, Minsk.

SHUL'MAN, Z. P.; BERKOVSKY, B. M.

"Similarity problems for a laminar boundary layer of a permeable distorted surface with heat and mass transfer in an incompressible fluid."

report submitted for 2nd All-Union Conf on Heat & Transfer, Minsk, 4-12 May 1964.

Inst of Heat & Mass Transfer, AS BSSR.

BERKOVSKIY, B.M.

Self-similar problem of heat and mass transfer in a laminar three-dimensional boundary layer on a permeable curved surface. Inzh.-fiz. zhur 7 no.1:55-58 '64. (MIRA 17:2)

1. Institute teplo- i massookmena AN BSSR, Minsk.

SHUL'MAN, Z.P.; BERKOVSKIY, B.M.

Approximate method for calculating the laminar boundary layer on a permeable curved surface. Inzh.-fiz. zhur. 7 no.8:131-132 Ag '64.
(MIRA 17:10)

1. Institut teplo- i massoobmena AN BSSR, Minsk.

BERKOVSKIY, B.M.

First Japanese National Conference on Heat Transfer. Inzh.-fiz. zhur.
no.11:120 N '64. (MIRA 18:2)

L 8838-66 EMT(1)/EMP(m)/ENA(d)/FCS(k)/ETC(m)/ENA(1) WH

ACC NR: AT5027193

UR/0000/65/000/000/0025/0060

AUTHOR: ^{44, 55} Berkovskiy, B.M.

ORG: ^{44, 55} Institute of Heat and Mass Transfer, AN BSSR, Minsk (Institut teplo- 1 massobmena AN BSSR) ^{48 B+1}

TITLE: A class of self-similar boundary layer problems for rheological power law fluids

SOURCE: AN BSSR. Institut teplo- 1 massobmena Teplo- 1 massobmen tel s okruzhayushchey gazovoy sredoy (Heat and mass exchange of bodies with the surrounding gaseous medium). Minsk, Nauka i Tekhnika, 1965, 25-60

TOPIC TAGS: ^{1, 55} boundary layer theory, ^{21, 44, 55} rheologic property, heat convection

ABSTRACT: The equations of ^{1, 55} fluid motion for fluids obeying the rheological power law are extremely complicated and do not yield solutions even in simple cases. It is therefore desirable to consider reasonable simplifications of the initial problems. Among such possible simplifications are the asymptotic cases of very rapid or very slow motions, when, as a rule the viscosity or inertia terms respectively can be neglected in the equations. The success of the boundary layer hypothesis for classical Newtonian fluids, which can be regarded as a special case of

Cord 1/2

ACC NR: AT5027193

rheological power-law media, leads to the supposition that this hypothesis would also be useful for materials which are close to Newtonian fluids in their rheological properties. The article surveys a wide class of self-similar problems involving the boundary layer equations for pseudoplastic and dilatant fluids. These formulations are obtained by the same method and include as special cases certain known self-similar problems involving Newtonian fluids. Topics treated by this approach in the article include: the steady state boundary layer, the unsteady state boundary layer, the thermal boundary layer, simultaneous free and forced convection, and free convection. The article concludes with two examples of calculation by this method and two appendices in which the mathematical basis of the method is expanded and generalized. Orig. art. has: 138 formulas.

SUB CODE: ME/ SUBM DATE: 02Jul65/ ORIG REF: 006 OTH REF: 013

PC
Card 2/2

BERKOVSKIY, B.M.

Exact solution of boundary layer equations. Dokl. AN BSSR 9 no.1:51-54
Ja '65. (MIRA 18:10)

1. Institut teplo- i massobmena AN BSSR.

L 22899-66 EWT(1)/EWT(m)/EWP(e)/EWP(t) IJP(c) JD/JG/AT/WH

ACC No: AP6006859

SOURCE CODE: UR/0181/66/008/002/0589/0591

AUTHOR: Shelekhin, Yu. L.; Votinov, M. P. Berkovskiy, B. P.

ORG: Leningrad Polytechnic Institute im. M. I. Kalinin (Leningradskiy politekhnicheskii Institut)

TITLE: Concerning exchange interactions of pairs of paramagnetic Cr^{+3} ions in a corundum lattice

SOURCE: Fizika tverdogo tela, v. 8, no. 2, 1966, 589-591

TOPIC TAGS: corundum, ruby, chromium, paramagnetic ion, crystal lattice, electron paramagnetic resonance, epr spectrum, nuclear spin, multiplet splitting

ABSTRACT: The authors indicate that when the concentration of Cr^{+3} ions in ruby is high there is a finite probability that these ions will be located close to one another, thus giving rise to an isotropic spin-spin interaction, which in turn leads to splitting into spin multiplets. Since the levels corresponding to states with spin 1, 2, and 3 are paramagnetic, they can be observed by the EPR method, since the intensity of the EPR spectrum for the state $S = 3$ should exhibit a larger temperature dependence than for the states $S = 1$ and 2. This circumstance can be used to separate the lines belonging to the multiplet $S = 3$. Earlier ex-

Card 1/2

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periments did not disclose the lines corresponding to all the transitions belonging to the spin multiplet $S = 3$. The authors have therefore carried out measurements with parallel orientation at 9,188 Mcs, and observed four weak lines at 780, 1621, 2820, and 3473 oe. For perpendicular orientation they observed three similar lines with resonances at 2548, 2944, and 3289 oe. The exchange coupling constants for the spin Hamiltonian are evaluated on the basis of these lines, and the values of the parameters of the spin Hamiltonian are found to be in better agreement with the theoretical parameters of a pair oriented perpendicular to the crystal axis, than for parallel orientation. It is concluded that comparison of the theoretical and experimental parameters of the spin Hamiltonian makes it possible to determine the orientation of the axis of the pair relative to the crystallographic axis and that the observed transitions belong to the multiplet $S = 3$ of the pair formed by the Cr^{+3} ions located at the nearest neighboring crystallographic axes. Orig. art. nos: 2 figures and 11 formulas.

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